FOREST PEST MANAGEMENT
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3420 Biological Evaluation
December 15, 1987

BIOLOGICAL EVALUATION OF THE EAST END TIMBER SALE, SNOW VALLEY RESIDENCE TRACT, LITTLE SNOW TIMBER SALE, AND SNOW VALLEY SKI AREA, ARROWHEAD RANGER DISTRICT, SAN BERNARDINO NATIONAL FOREST

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ABSTRACT

The East End timber sale, the Little Snow timber sale, the Snow Valley recreation residence tract, and the Snow Valley ski area on the Arrowhead Ranger District, San Bernardino National Forest, were evaluated for pest conditions of the vegetation. The most damaging pest present is western dwarf mistletoe on the Jeffrey pine. It is most serious in the residence tract and parts of the East End sale. The ongoing East End timber sale is adequately addressing this situation outside of the residence tract. In the residence tract, a sanitation harvest and broom pruning of individual high value trees would improve stand vigor and longevity. Adjusting the stocking level appropriate to the site would also improve stand vigor. If regeneration is desired, some openings are required, along with control of pocket gophers and competing vegetation. In the ski area, activities are necessary to maintain and improve stand vigor. These include adjusting stocking levels, removing excess white fir and those with heavy true mistletoe infections, and reducing competing vegetation to encourage pine regeneration.

INTRODUCTION

On September 9, 1987, we met with the following individuals from the San Bernardino NF to examine and discuss the pest situation in the East End and Little Snow timber sales, and in the Snow Valley recreation residence tract: Sandy Hogan, Ernie Del Rio, Fred Krueger, Steve Loe, Art Gaffrey, and Mark Bethke. On September 10, we made a more intensive field visit of the above

UNITED STATES
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REPLY TO: 3420

DATE: DEC 15 1987

SUBJECT: Biological Evaluation of the East End Timber Sale and Surrounding Areas, Arrowhead Ranger District

TO: Forest Supervisor, San Bernardino National Forest

At the request of Sandy Hogan, District Ranger, Arrowhead Ranger District, personnel from Forest Pest Management evaluated four areas around Snow Valley for condition of the vegetation and associated pests. The four areas included the East End and Little Snow timber sales, the Snow Valley recreation residence tract, and the Snow Valley ski area. This report documents their findings and provides alternatives that address the management of the vegetation to reduce the impacts of forest pests.

The most significant pest is western dwarf mistletoe infecting Jeffrey pine around the residence tract. Infections in many of the trees are severe and the future existence of a healthy stand is questionable without management actions. One alternative, pruning of witches' brooms, has been successfully practiced in a number of recreation areas in California. Through the use of designated suppression monies, FPM has funded these types of projects when other revenues were not available. If the District desires, a broom pruning project in the residence tract could be initiated using such funding. A project proposal, including an environmental analysis, work plan, and economic evaluation, is required to compete for such funding. If the District is interested in such a project, they may contact FPM personnel for more information and assistance.

If there are any questions on this evaluation or if additional assistance is required, please contact Gregg DeNitto at 415-556-6940.

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areas and the Snow Valley ski area with Ernie Del Rio. The purpose of the visit was to examine the pest situation, primarily dwarf mistletoe, in the areas and to evaluate how effectively the existing and planned harvests are treating the stands. In addition, the District desired management alternatives that would address the severe dwarf mistletoe infestation around the recreation residence tract.

The East End sale was originally 313 acres and included what is now the Little Snow sale. Little Snow was established as a 75 acre unit because of the large timber volume to be harvested from the original sale. Because of public input, a 23 acre area in and around the recreation residence tract was also removed from the original sale. The East End sale is presently being harvested on 215 acres. The objectives of the treatment are:

1) To establish a 0-15 year old age class to achieve an all-age, all-size, diverse species stand structure.
2) To maintain the health and vigor of the stand.
3) To control or eliminate forest pests.

Similar objectives exist for the Little Snow sale. However, nesting spotted owls have been observed in the sale area which may alter stand management objectives. Specific management objectives for the residence tract are being developed. General objectives are to produce an aesthetically acceptable forested environment comprised of healthy and vigorous trees.

EAST END SALE/SNOW VALLEY RESIDENCE TRACT

OBSERVATIONS AND DISCUSSION

The stands in the East End timber sale and residence tract are relatively homogeneous, two-storied stands containing mainly Jeffrey pine. Scattered white fir, sugar pine, incense-cedar, and black oak also are present, primarily in the understory. This aggregation has a 20-40% canopy cover in the overstory. Most of the pines in this layer are greater than 18 inches dbh. Cover in the understory varies from 0-70%. Brush species are common and include whitethorn, greenleaf manzanita, and bracken fern. Grasses and sedges are also present in most of the openings. Black oak occurs in small groups among the more common pine aggregation. These tend to be pure oak, sometimes with a few shade-tolerant conifers in the understory.

Three organisms are, or could be, significant pests in the East End sale and the residence tract. Western dwarf mistletoe, Arceuthobium campylopodum, is widespread in much of the sale area and is especially severe in the residence tract. All size classes of Jeffrey pine are affected. In some areas, many of the trees are severely infected (Hawksworth ratings of 5 or 6). Smaller size classes of Jeffrey pine are being impacted by annual infections from the overstory seed sources. Many of these understory trees will never grow into the overstory because of severe suppression and deformation because of the disease. Severe infections in individual trees will significantly increase their susceptibility to attack by bark beetles.

A second disease in the area is annosus root disease, caused by Heterobasidion annosum. Several disease centers were observed. This disease attacks the roots of all conifer species resulting in expanding centers of tree mortality. All size classes of trees are susceptible to the fungus. In addition to tree mortality, infection can lead to root decay and increased susceptibility of trees to failure and resultant hazard to people and property.

The third pest, which could interfere with regeneration efforts, is the pocket gopher, Thomomys sp. Gopher mounds and activity were observed in the stands. Herbaceous vegetation is present that could support a significant population, especially after harvesting activities if there are no subsequent vegetation management activities. Without proper treatment of the vegetation and gophers, regeneration efforts could be adversely affected through seedling destruction by the gophers.

In addition to biotic pests, one other controllable factor is affecting tree and stand vigor. Stocking density is high in some parts of the stands. Basal area measurements at some points exceeded 300 sq.ft./ac. Suggested stocking for stands of this age on this site on the San Bernardino NF are in the range of 100-120 sq.ft./ac. This level will optimize tree vigor. Higher levels will increase the probability of insect attack and tree mortality. This is especially the case during drought periods. High stocking levels also exacerbate the stress caused by dwarf mistletoe where infection levels are high.

MANAGEMENT ALTERNATIVES

1) NO ACTION. Of the three pests in these areas, western dwarf mistletoe will have the most significant impact on the trees. Pine mortality and lack of pine regeneration will be the two primary impacts on the recreation and visual resources. As the mistletoe intensifies, mortality of the Jeffrey pine overstory will increase. As overstory pines die, openings will seed in with pine, sometimes as very dense regeneration. Because of this density and subsequent dwarf mistletoe infection from the overstory, suppression will occur and considerably extend the time until pines enter the upper canopy level. In areas of heavy use, compaction and trampling will inhibit the ability of the pine to naturally regenerate. Slowly, the dwarf mistletoe will spread into surrounding uninfested areas. A similar pattern of overstory mortality and understory suppression and dwarf mistletoe infection will occur. Where present, non-hosts may enter the overstory following pine mortality. The white fir, however, may not survive very long after release. The area is basically a pine site and fir will encroach, but its longevity, especially after loss of a covering canopy, is limited.

The other pests will have more localized effects on the vegetation than dwarf mistletoe. Annosus root disease centers will continue to expand in most cases. Because of the underground nature of the fungus, our inability to know its exact location in root systems, and the intertwining of the surrounding root systems, we cannot predict where, or if, additional infection and mortality will occur around existing centers. Most disease centers last several decades and slowly expand outward at a rate of 1-2 feet per year. When

non-susceptible species are encountered, such as black oak and brush species, outward spread of the fungus is usually curtailed. Conifer regeneration within root disease centers is often killed as a result of infection by the fungus. Expanding openings usually develop that are vegetated by grasses and brush species which serve as good habitat for pocket gophers.

Pocket gophers will feed on grasses and forbs for the most part, but will attack tree seedlings when the herbaceous vegetation is unsuitable. Increases in the amount of herbaceous vegetation will result in an increase in the population of gophers, thereby further threatening any conifer regeneration.

The following scenario is envisioned for the East End sale and Snow Valley residence tract in 5 decades if no action is taken. Many of the large, severely dwarf mistletoe-infected Jeffrey pines will die. This is especially true around the residence tract where the infestation is severe. Much of the stand will be comprised of dense thickets of Jeffrey pine (2-10 inches dbh) that are infested by dwarf mistletoe beneath heavily infested, scattered Jeffrey pines and other tree species. Infection levels will be moderate to severe in most trees and growth and vigor will be poor. Interspersed with these thickets will be solitary and small groups of trees other than Jeffrey pine. Some of these other species, especially sugar pine, will extend into the upper canopy that remains. Dwarf mistletoe will have spread into surrounding areas and will be intensifying. The likelihood of tree mortality in these areas will increase because of the added stress, in addition to any overstocking or drought stress. Some of the annosus root disease centers will be revegetating with native conifers. Because of the elapsed time, the fungus will have died out from most of the existing centers. Continued use of borax on conifer stumps during any salvage activities will greatly reduce the opportunity for the creation of any new centers. Regeneration in some openings will be limited because of pocket gophers or recreational activities.

2) SANITATION. A prescription would be developed that would reduce the level of dwarf mistletoe in the stands. The pest management objectives would be to improve stand vigor by removing trees with a reasonable probability of mortality during the following 10-15 years and to reduce the intensification and spread of dwarf mistletoe. Trees with severe dwarf mistletoe infection (Hawksworth ratings of 5 and 6) would be removed. Trees with Hawksworth ratings of 0-3 could be left, depending on their condition and location. It is advantageous to remove trees with a rating of 4, but they may be retained depending on the desire for vegetative cover at the specific site. Dense thickets would be thinned, removing dwarf mistletoe-infected trees and trees of poor vigor (reduced needle complement, poor foliage color, minimal height growth, etc.) when sufficient other trees are available. When infested Jeffrey pines are retained in the top layer and mixed species occur beneath them, then Jeffrey pines in the understory should be discriminated against. In situations where infested Jeffrey pines are overtopping black oaks, the pines could be removed to release the oaks.

Because of the severity of the dwarf mistletoe infestation, tree removal would create some openings in the stand. These openings may regenerate naturally, but competition from other vegetation and the presence of gophers will limit seedling survival and growth. Remaining infested pines surrounding these

openings would also serve as reservoirs of dwarf mistletoe and could infect the pine regeneration. The release effect from overstory removal and thinning on smaller size classes of pines may result in increased growth rates and their advancement into the upper canopy levels. Removal of the infested overstory would lessen the probability of additional infections of the understory.

3) BROOM PRUNING. This specialized operation can be effective in reducing dwarf mistletoe impact to individual trees. The objective is to reduce the number of dwarf mistletoe witches' brooms in a tree, thereby reducing the stress and increasing the survival of individual trees. Other branch infections may also be removed for other purposes (e.g. tree appearance), but this should not be considered a dwarf mistletoe eradication effort. Pruning efforts should not reduce the live crown ratio below 30%. In most situations, it is advantageous to combine this operation with other actions in an overall management program that reduces other stresses on the residual stand and provides for future forest cover.

4) INTEGRATED PEST MANAGEMENT. The objective of this alternative is to provide a healthy, vigorous forest stand with minimal impacts from pests, while meeting management objectives for visual quality and recreation. The East End sale in progress, beyond the recreation residences, will fulfill this alternative. In the residence tract, additional efforts at retaining individual trees may be required. Trees with severe dwarf mistletoe infection (Hawksworth ratings of 5 or 6) may be removed. If removal is not desirable, then pruning witches' brooms is suggested. If the trees are retained and not pruned, it must be understood that they have a high probability of dying in 1 to 2 decades, probably from bark beetle attacks and/or flatheaded borer infestations. In addition to these trees, pines within 20-30 feet may also come under attack by bark beetles. Stocking of the remaining trees needs to be adjusted in many areas to reduce competition. Specific levels should be determined on-site that balance the biological requirements with socio-political realities. Marking guidelines should include dwarf mistletoe, but all infected trees do not need to be removed if there are no other options. Species not susceptible to western dwarf mistletoe should be kept as long as possible to provide forest cover and act as buffers against dwarf mistletoe spread. Small openings may be planted, but if there is dwarf mistletoe in the overstory trees, then only non-susceptible species should be planted. Any regeneration attempts will need control of pocket gophers to be successful. Regeneration of annosus root disease centers will require the planting of hardwoods only. Conifer stumps should be treated with borax immediately after tree falling to reduce infection by H. annosum.

Implementation of this alternative will probably not attain all of the objectives originally desired. Specifically, development of a 0-15 year old age class will be limited, at least for Jeffrey pine. Through regeneration efforts, other species may be introduced in greater proportions into the stands. Their longevity, however, compared to Jeffrey pine, may be reduced. This alternative will continue to provide a forest cover around the residences even though tree health may not be optimal. If stocking is left higher than biologically desirable, then some mortality can be expected, especially of overmature trees that may have moderate or higher levels of dwarf mistletoe infection. If denser aggregations of smaller Jeffrey pines are thinned, then they may outgrow some of the adverse effects of dwarf mistletoe, unless an infected overstory is nearby for infection from above.

LITTLE SNOW SALE

OBSERVATIONS AND DISCUSSION

Stands in the Little Snow sale are similar to those in the East End sale. They are generally two-storied, with Jeffrey pine the principal species. The overstory has a 20-40% cover of pine. The understory is 10-70% pine and 10% black oak. White fir, incense-cedar, and sugar pine are present as scattered individuals, usually in the understory. A brush layer of 70% whitethorn and 30% greenleaf manzanita is usually present. A second aggregation of single-story black oak with 70-100% cover is also present. In general, trees in this sale are smaller than in the East End sale area, with regeneration more common. Dwarf mistletoe was not observed. The trees are in relatively good condition as far as biotic pests.

Because of the absence of dwarf mistletoe and better tree condition, the timber sale marking is lighter than in the East End sale. It appears to be appropriate for the site and stand conditions. There are clumps of sapling and pole size Jeffrey pine that would benefit from a precommercial thinning following the sale. Releasing them would reduce stagnation and suppression and accelerate their advance into the upper canopy layer.

SNOW VALLEY SKI AREA

OBSERVATIONS

The Snow Valley ski area is on the opposite side of Highway 18 from the previously discussed areas. It is on a north-facing slope and benefits from the increased available moisture. The management objectives for this area are to provide a healthy, vigorous forest cover. The principal resources are visual and recreation. In addition, forest cover must be retained to reduce the amount of wind affecting the ski area.

Compared to the stands discussed above, these stands have a higher proportion of white fir, especially in the understory, and have higher stocking levels overall. The stands are two or three storied. The top layer is Jeffrey pine, white fir, and occasionally sugar pine. Cover ranges from 10-40%. The second layer, if present, is white fir, black oak, and incense-cedar. Cover is 0-30%. The third layer is white fir, incense-cedar, and black oak with a cover of 30-60%. Brush species include whitethorn, greenleaf manzanita, and chinquapin.

Three pest organisms were observed. Western dwarf mistletoe was present in the Jeffrey pine on the lower slope. True mistletoe of white fir (Phoradendron bolleanum ssp. pauciflorum) was seen mainly in the tops of some of the larger white firs. Some mortality and top-killing of the larger white fir (14-20 inches dbh) had occurred and involved fir engraver (Scolytus ventralis) activity.

MANAGEMENT ALTERNATIVES

1) NO ACTION. Tree mortality will continue with yearly fluctuations depending on the amount of precipitation. Jeffrey pines will be successfully attacked sporadically by bark beetles because of limited soil moisture. This limited moisture will result from periodic droughts and overstocking. Top-killing of white fir will occur, often as a result of the interaction of true mistletoe, stocking levels, and fir engraver. In some instances, top-killing may develop into whole tree mortality. Although all species will suffer mortality, a disproportionate share will be white fir. This is especially true for trees in the second layer where the density of white fir is greater.

Western dwarf mistletoe will slowly spread in the Jeffrey pine on the lower slope. Because of the mixed species in the stands, spread will be interrupted in some directions and the rate of horizontal spread will be slower than normal (average 1-2 feet per year) through the stand. The disease will intensify in individual trees, and these trees will increasingly become subject to successful bark beetle attacks.

Even though mortality will be a factor in this stand in the future, the general appearance will remain similar to its present condition. Specific areas will change as small openings are created and regenerate. Tree size and stand structure will not significantly change, with 2 to 3 layers and total cover of 50% and greater. Regeneration of Jeffrey pine will occur in openings where mineral soil is exposed. As the Jeffrey pine in the overstory ages and dies, the shade-tolerant white fir will replace it.

2) VEGETATION MANAGEMENT. Silvicultural prescriptions would be developed that adjust the species composition and stocking level of the stands. The present species composition is somewhat heavier to white fir than is optimal and adjustments should be made to reduce this component, especially in layers 2 and 3. The stocking levels need to be reduced to increase stand vigor, while maintaining other resource objectives. Target levels should be 100-120 sq.ft./ac. Small openings may be created (1/4-1 ac.) in the stand to increase the amount of pine regeneration. At present, pine regeneration is limited because of the canopy cover and the absence of bare mineral soil. Creating openings and scarifying the site will encourage the development of pine regeneration, either from natural origin or by planting. Pine regeneration should not be encouraged on the lower slope because of dwarf mistletoe, unless there will be no opportunity for infection from the surrounding overstory. When selecting trees for removal, white fir with heavy infections of true mistletoe in the top should be discriminated against. These trees are susceptible to fir engraver attack and may be expected to suffer top-killing or mortality.

BIOLOGY OF PEST ORGANISMS

WESTERN DWARF MISTLETOE

Western dwarf mistletoe (Arceuthobium campylopodum) infects principally ponderosa, Jeffrey, and knobcone pines, and occasionally Coulter and lodgepole pines. This parasite is a flowering plant which acquires its nutrients and water from its host. It requires living host tissue to survive.

Dwarf mistletoes spread by means of seed. In the fall the fruit ripen and seeds are forcibly discharged. The seed is covered with a sticky substance. When a seed lands in a host tree crown, it usually sticks to a needle or twig, where it remains throughout the winter. The following spring the seed germinates and penetrates the twig at the base of the needle. For the next 2-4 years, the parasite grows within the host tissues, developing a root-like system within the inner bark and outer sapwood, and causing the twig or branch to swell. Aerial shoots then develop and bear seed in another 2-4 years.

Dispersal of dwarf mistletoe seeds is limited to the distance the seeds are discharged. From overstory to understory, this is usually 20 to 60 feet, but wind may carry them as far as 100 feet from the source. A rule of thumb is that the seeds can travel a horizontal distance equal to the height of the highest plant in an infected tree. There is some evidence that long distance spread of dwarf mistletoe is occasionally vectored by birds and animals.

Vertical spread within tree crowns of most dwarf mistletoes is limited to less than one foot per year because of foliage density. In Jeffrey pines, the average annual vertical rate of spread is 4-6 inches.

Dwarf mistletoes are easy to identify because they are generally exposed to view within a tree's crown. Signs of infection include the yellow-green to orange mistletoe plants, basal cups on a branch or stem where the plants were attached, and detached plants on the ground beneath an infected tree. Symptoms include spindle-shaped branch swellings, witches' brooms in the lower crown, and bole swellings.

ANNOSUS ROOT DISEASE OF PINE

Heterobasidion annosum is a fungus that attacks a wide range of woody plants, causing a decay of the roots and lower bole and death of sapwood and cambium. All pines in California are susceptible; hardwoods are rarely affected.

The fungus becomes established in freshly cut stumps from air-borne spores produced by fruiting bodies (conks). It then grows into the root system and may spread to adjacent healthy trees via root contacts. Infected pines are usually killed rather rapidly when H. annosum girdles the root collar. After a suitable period of time, conks are produced under the bark of dead trees, in decayed stumps, or in the duff at the root collar.

Local spread of H. annosum outward from a stump results in the formation of disease centers that have dead trees in the middle and dying trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings or groups of non-host plants. The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Pines may seed in or be planted in centers and survive for a few years, but they eventually will be infected and die.

WHITE FIR TRUE MISTLETOE

White fir mistletoe, Phoradendron bolleanum ssp. pauciflorum, is a true mistletoe having small, green leaves and round, white berries. It can only survive in living white fir tissues, principally as a water parasite utilizing water and minerals from the host. In California, it is limited geographically to the Sierra Nevada south of Interstate 80, and to the mountains of southern California.

This pest is spread mainly by birds, including robins, bluebirds, thrushes, phainopeplas, and cedar waxwings. Birds feed on the berries, digest their pulp, and excrete the living seed, often depositing them onto susceptible trees. A viscous coating and hair-like threads on the outer surface of the seeds attach them firmly to twigs and branches, where they germinate and infect host tissues.

Young or small trees are seldom infected by white fir mistletoe. In nearly all cases, initial infection occurs on the branches of larger or older trees because birds prefer to perch in their tops. Severe buildup of mistletoe often occurs in an already-infected tree because birds are attracted to and may spend prolonged periods feeding on the mistletoe berries.

Heavily infected trees are weakened, reduced in growth rate, and sometimes killed. Weakened trees are predisposed to attacks by insects and often die during drought or other periods of stress. Severe infection of white fir can result in top-kill in combination with the fir engraver (Scolytus ventralis). Branches and tree tops heavily-laden with true mistletoe often break during wind storms, increasing the hazard to people and property in campgrounds and other developed sites.

White fir mistletoe is recognized by the clumps of mistletoe foliage in the tree. These mistletoe plants are usually in the tops of larger, older trees. With severe infections, virtually all of the tree's foliage may be replaced by mistletoe plants. Dead spike tops are common in white fir stands heavily infected by this parasite.

FIR ENGRAVER

The fir engraver (Scolytus ventralis) attacks both white and red fir in California. Trees ranging in size from large saplings to overmature sawtimber are susceptible. Attacks can cause patch-killing of cambium along the bole, top-kill, or tree death. Top-kill or death occur most often in firs that have been weakened by root disease, dwarf mistletoe, overstocking, soil compaction, sunscald, logging injury, or drought. The fir engraver also breeds in slash and windthrown trees.

The fir engraver usually completes its life cycle in one year, sometimes two. Adults fly and bore into trees or green fir slash from June to September; larvae, pupae, and adults over-winter under the bark. Pitch tubes are not formed as they are with pine bark beetles; the usual evidence of attack is boring dust in bark crevices along the trunk and pitch streamers on the mid and upper bole. Trees colonized early in the summer may begin to fade by early fall, but those colonized later in the year usually do not fade until the following spring or summer, often after the beetles have emerged.

POCKET GOPHER

The pocket gopher, Thomomys bottae, is a rodent in the family Geomyidae. They spend most of their life in an extensive tunnel system. The surface openings to their tunnel system are kept well plugged except while burrowing, gathering food a few inches around feed holes, or sometimes following rains. They are highly solitary individuals except when mating or when a mother has young, usually fighting to the death if two are put together.

Pocket gophers do not hibernate and, when burrowing under snow, they deposit the excavated earth in abandoned snow tunnels. The earth cores become visible when the snow thaws.

There is one litter per year born in late spring or early summer. Litter size averages 5 or 6 but may range from one to more than a dozen. Dispersal of the young is often done above ground in late summer or early fall. The population turnover rate is often 70-80% per year due to natural causes.

Pocket gophers feed on a great variety of forbs, grasses, seeds, acorns, tubers, bulbs, roots, bark of trees, and when protected by snow, they gnaw on branches and main stems of conifers several feet above ground.

The most practical method of controlling large numbers of gophers is to place toxic baits underground by hand probing or by use of a mechanical burrow builder. Of the rodenticides that are readily available, strychnine alkaloid is the most effective toxicant. For cleanup work or for small areas where only a few animals are involved, trapping is an effective means of control. Fumigation is generally unsatisfactory because of the extent of the burrow system and the fact that gophers may plug off their burrows when the fumigant is detected.